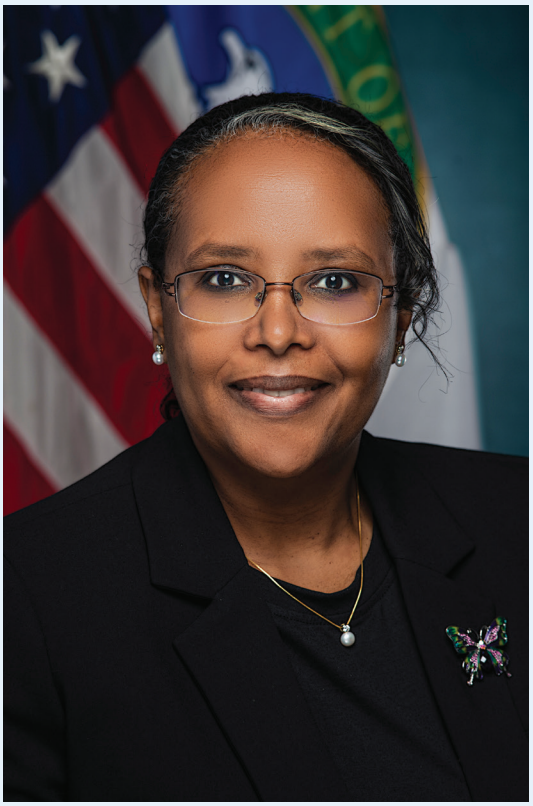

DEPARTMENT OF ENERGY

Q&A: Asmeret Asefaw Berhe reflects on her tenure as DOE Office of Science director

As Berhe returns to academia, the soil biogeochemist discusses the federal agency's work on major research facilities, AI algorithms, and training the next generation of scientists.

Asmeret Asefaw Berhe started in May 2022 as head of the US Department of Energy's Office of Science (SC), which manages the most federal dollars for basic physical sciences research—$8.2 billion for the current fiscal year. She was the first person of color to lead the agency. She resigned in March to return to her professorship in soil biogeochemistry at the University of California, Merced.

Berhe spoke to Physics Today on 21 March, a few days before leaving office, about her accomplishments and SC's efforts in diversity, equity, and inclusion. The text of the interview was edited for clarity and length.

PT: Why are you leaving after less than two years on the job?

BERHE: To be fair, it's been three years since I started this journey, including the 13 months I had to wait for Senate confirmation. It's a combination of personal and professional reasons. I've been gone from my professional career for three years.

PT: What do you consider some of the research highlights at SC labs during your tenure?

BERHE: The excavation of the caverns for the Deep Underground Neutrino Experiment in South Dakota is being completed, and the milestones for the neutrino detectors are being met. The charge to the Particle Physics Project Prioritization Panel, which I issued, has been completed. [See Physics Today, February 2024, page 18.]

We could talk about progress on the Electron–Ion Collider [a proposed facility at Brookhaven National Laboratory that just received approval from DOE to procure long-lead-time items, such as a cryogenic plant and superconducting magnets]; the Stable Isotope Production and Research Center [a $325 million facility scheduled for completion in 2032] at Oak Ridge National Laboratory to shore up the supply of stable isotopes; and quantum technologies at the five quantum information research centers we support across the country. Each is led by a national laboratory and is leveraging world-class facilities.

During my tenure, we celebrated a new era of exascale scientific computing with Frontier [currently rated the world's fastest high-performance computer] at Oak Ridge. And the Aurora at Argonne National Laboratory is already ranked second-fastest computer in the world even before it's been completed. [Aurora is expected to open to users in January 2025.] Those aren't just fast machines; they are among the most energy efficient in the world.

We've made strides in developing an integrated research infrastructure that will apply our computing capacity across the breadth of our science programs. We funded a high-performance data facility at the Thomas Jefferson National Accelerator Facility, a partnership with Lawrence Berkeley National Laboratory. We launched programs in fusion to advance the science as well as to think about what comes after the science is mature enough to be pushed into the technology development phase.

We've worked to upgrade the labs and have added new capabilities, including completing the Linac Coherent Light Source-II at SLAC. I charged SC's six advisory committees with setting priorities for new facilities and facility up-

grade priorities for the next decade.

PT: Among the recent initiatives at SC are two diversity, equity, and inclusion programs that awarded their first grants last year. How do those programs work?

BERHE: RENEW [Reaching a New Energy Sciences Workforce] is for training the next generation of scholars. FAIR [Funding for Accelerated, Inclusive Research] is for capacity building at emerging research institutions. They're complementary. Combined, they constitute about 1% of our funding.

Both programs have partnerships with the labs. RENEW leverages SC's national laboratories, user facilities, and other research infrastructures to provide training opportunities for undergraduate students, graduate students, and postdoctoral researchers at academic institutions not currently well represented in the SC portfolio.

I didn't create RENEW and FAIR; they were well underway when I took office. Publicly funded science should serve the public, and broadening participation of people from all walks of life is very important for many reasons. The nation needs a vibrant workforce that can be competitive across all sorts of different avenues. That workforce should come from every part of this country, and we should ensure that it does not remain an exclusive club of only the well-connected people. A student from Iowa, Mississippi, or Wyoming should not have opportunities limited for them just because of geography or the inequitable distribution of public resources.

The DOE ecosystem, including our national labs, have worked tirelessly to ensure that STEM does not remain an enterprise where people from different walks of life are not well represented or there are barriers to their entry. That includes women, people of color, people from rural areas, and those with lower socioeconomic status.

PT: How do you measure success in those programs?

BERHE: There are specific things that the institutions are proposing to do. Once we peer review the proposals and the institutions are selected, we evaluate them to make sure that they've actually delivered. For RENEW, we track how many students we train, and we plan to follow how these internships contribute to career success.

PT: What progress has DOE made on biofuels?

BERHE: Researchers at our four Bioenergy Research Centers have developed dedicated bioenergy crops, including switchgrass and miscanthus, that are tailored for growth on underutilized lands in different parts of the country and that could grow with minimal nutrients and less irrigation. They are now ripe for testing on a large agricultural scale.

There's been major progress in developing methods to break down biomass in an efficient and economic biochemical manner. Scientists are gaining new insights into the composition of the plant cell-wall material.

PT: How is DOE thinking about the potential explosion of new demand for electricity from the rapid growth of AI?

BERHE: Generative AI in particular has major energy requirements, and that rightfully has worried a lot of people. The challenge posed by these large language models comes down to two things: efficiency of the hardware and the algorithms that are used to train and to use the models.

SC funds research into innovative microelectronics technologies that promise to greatly reduce energy usage. We have AI test beds that evaluate new kinds of computing systems from multiple vendors, and we can train models using less energy than is typically deployed in typical GPU clusters. And SC has long funded research on more efficient algorithms. We foresee that we're going to be able to take advantage of our exascale computers to design and validate new energy-efficient AI algorithms.

We're also working to make data training more efficient. Trustworthiness requires high-quality data and state-of-the-art approaches for using that data to train the models. Self-checking AI systems that are appropriate for high-consequence applications will take a lot of data and a lot of computing power and energy. We view energy as the major challenge going forward.

David Kramer PT